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Processing qualities of apple cultivars



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Agriculture Canada research establishments.

Processing qualities of apple cultivars

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SUMMARY

This publication summarizes our evaluation of apple cultivars for commercial storing and processing. Established varieties and promising selections grown at the Smithfield Experimental Farm up to and including the 1981 crop year are included. In addition to the saucing and slicing qualities reported in previous editions, this update includes results obtained in recent years on the juicing properties of some cultivars.

Many of the newer varieties and scab-resistant selections were found to be suitable for specific packs. They compared favorably with older standard varieties in quality attributes and other properties affecting overall performance for processing. Scab-resistant lines are of particular interest because of their potential for reducing production costs.

INTRODUCTION

Apple cultivars grown at the Smithfield Experimental Farm have been evaluated yearly since 1959 for their commercial processing potential. Most of the varieties being grown in Canada as well as promising scab-resistant seedlings have been tested. This publication includes results obtained in recent years on the juicing qualities of cultivars, in addition to the saucing and slicing qualities reported previously. The evaluations are based on results up to and including the 1981 crop year.

Numbered selections starting with 0 are Ottawa selections. Unless otherwise noted, the apples were grown at the Experimental Farm, Smithfield.

After they were picked, the apples were placed in refrigerated storage at 0°C. Samples were examined and tested periodically for firmness in order to assess storage properties. Processed packs were prepared when the fresh-stored fruit reached a firmness index of approximately 6.4 kg on a fruit-pressure tester fitted with an 11-mm tip.

Most of the cultivars were efficiently peeled and cored in conventional mechanical peelers, and required little hand trimming. The few that were difficult to peel have been identified in the text. This difficulty was usually associated with apples that were larger than 9 cm in diameter, had pronounced angular or lopsided shapes, or had knobby ends-- characteristics peculiar to certain cultivars.

The terms 'low,' 'medium,' and 'high' contents of soluble solids (SS) and titratable acidity (TA) are used to indicate the following levels:

	Soluble solids (%)	Titratable acid (%)
Low	< 10.5	< 0.4
Medium	10.5-13.0	0.4-0.8
High	> 13.0	> 0.8

The methods used to prepare our test packs were similar to commercial methods. For the slices test pack, the apples were peeled, sliced, dipped in sodium metabisulfite, fast frozen at -29°C, and stored at -20°C until evaluated as pie. For the sauce test pack, the finisher, cooker-heater, and retort were operated to provide conditions similar to those used in industry. Our rating of a cultivar for sauce was based on its usefulness for blending with readily available cultivars such as McIntosh, and not necessarily on its properties as a finished sauce by itself. (For an explanation of terms used in describing texture, see Mohr, W. P. 1973. Applesauce 'grain.' J. Texture Stud. 4(2):263-268.) For the juice test pack, the apples were chopped in a Fitzmill, pressed in a Willmes press, and the juice clarified, using enzyme at 15°C. Total yield is the percentage by weight of juice recovered from apples used. Usable juice is the total percentage pressed less the percentage volume settled during clarification. Specific gravity is determined on clarified juice. Juicing properties have been assessed only in recent years and are not available for all cultivars.

Ratings of excellent, good, fair, and poor are used throughout the report to assess properties of interest. Table 1 defines these ratings for the three types of test packs.

Table 1. Ratings for the three pack types

	E (Excellent)	G (Good)	F (Fair)	P (Poor)
<u>SLICES</u>				
Flavor	intense, normal	moderate, normal	mild, normal	flat, perfumy, off
Color	bright intense yellow	yellow	lacking in color	dull pink or tan
Texture	firm, crisp, tender	fairly firm, tender	slightly soft or slightly tough	soft, sloughed, or rubbery
Wholeness	completely whole	mostly whole	some whole pieces	no wholeness retention
<u>SAUCE</u>				
Flavor	intense, normal	moderate, normal	mild, normal	flat, perfumy, off
Color	bright intense yellow	yellow	lacking in color	dull tan or pink
Texture	grainy	some grain	little grain	smooth, no grain
<u>JUICE</u>				
Flavor	intense, normal	moderate, normal	mild, normal	flat, perfumy, off
Color	bright intense yellow	yellow	lacking in color	dull, dark
Total yield	> 80%	70-80%	60-70%	< 60%
Usable yield	> 70%	55-70%	40-55%	< 40%
Specific gravity	> 1.065	1.050-1.065	1.035-1.050	< 1.035

The following cultivars are grouped according to their type as commonly referred to by the industry.

MCINTOSH TYPE

Geneva McIntosh

Bud mutation of McIntosh.

Harvested late September. Processed late November to early January. Medium-sized fruit. Medium SS and TA. Easy peeler.

Slices: Tested 2 years. Cream-tan. Soft, smooth texture. Mild flavor. Poor wholeness retention. Rated poor overall.

Sauce: Tested 2 years. Pale cream-yellow to light tan. Smooth texture. Mild flavor. Rated poor overall.

Historical McIntosh

Budwood three generations from original tree in Dundas County.

Harvested late September. Processed early January. Medium-sized fruit. Low SS and medium TA.

Slices: Tested 1 year. Dull yellow. Soft texture. Mild flavor. Fair wholeness retention. Rated fair overall.

Sauce: Tested 1 year. Bright light green-yellow. Fair to good texture and flavor. Rated good overall.

Imperial McIntosh

Bud mutation of McIntosh.

Harvested late September. Processed early January. Medium-sized fruit. White flesh. Medium SS and TA.

Sauce: Tested 1 year. Light dull yellow. Smooth texture. Mild flavor. Rated fair overall.

McIntosh VC309

Virus-tested McIntosh strain, Horticultural Research Institute of Ontario, Vineland Station.

Harvested late September. Processed late November. Medium-sized fruit. Medium SS and TA.

Slices: Tested 1 year. Cream-tan. Soft, smooth texture. Slightly aromatic flavor. Poor wholeness retention. Rated poor overall.

Sauce: Tested 1 year. Slightly tan. Slightly grainy texture. Normal flavor. Rated fair overall.

Juice: Tested 1 year. Medium amber. Fair flavor. Good total yield. Fair percentage of usable juice after clarification. Excellent specific gravity. Compares well with Northern Spy. Rated good overall.

Better commercial processing potential for juice than for slices or sauce.

Macspur

Compact spur mutant of McIntosh.

Harvested late September. Processed late November. Medium-sized fruit. Low to medium SS and medium TA.

Slices: Tested 2 years. Cream-yellow. Very soft texture. Mild flavor. Poor wholeness retention. Rated poor overall.

Sauce: Tested 4 years. Pale cream-yellow. Slightly grainy texture. Mild flavor. Rated fair overall.

Juice: Tested 1 year. Fair to good color. Mild flavor. Fair total yield. Poor percentage of usable juice after clarification. Rated fair overall.

Barely acceptable either as sauce or as juice; poor as slices.

Rogers McIntosh

Bud mutation of McIntosh.

Harvested late September. Processed early January. Medium-sized fruit. Fresh fruit had best appearance of all McIntosh strains tested.

Medium SS and TA.

Slices: Tested 1 year. Light green-yellow. Tender, soft texture.

Normal flavor. Fair to good wholeness retention. Rated fair overall.

Sauce: Tested 1 year. Cream-white. Smooth texture. Mild flavor. Rated poor overall.

RED DELICIOUS TYPE

Miller Sturdeespur Delicious

Whole tree mutation in a Starking Delicious orchard.

Harvested mid-October. Processed late December to early January.

Large-sized fruit. High SS and low TA. In 1979, moldy core. Difficult peeler.

Slices: Tested 2 years. Bright yellow to cream-yellow. Slightly tough texture. Good flavor. Good wholeness retention. Rated good overall.

Sauce: Tested 2 years. Bright yellow. Coarse texture. Good flavor. Rated good overall.

Juice: Tested 1 year. Poor dark amber. Slightly aromatic flavor. Good total yield. Good pulp settlement during gravity clarification, giving good percentage of usable juice recovery. Rated fair overall.

Texture seems to be a problem in years tested -- tough slices and coarse sauce.

Richared Delicious

Bud mutation of Delicious.

Harvested mid-October to late October. Processed mid-January to late January. Medium-sized fruit. Medium to high SS and low TA. Difficult peeler. Usually develops water core in storage.

Slices: Tested 13 years. Bright intense yellow. Tender to slightly tough texture. Mild flavor. Usually good wholeness retention. Rated good overall.

Sauce: Tested 14 years. Bright intense yellow. Fairly coarse texture. Mild flavor. High water absorbency. Rated good overall.

Overall ratings have been consistently good in the years tested since 1972. Prior to 1972, the rating for both sauce quality and slice quality was poor because of the cream color, coarse texture, and flat flavor.

Starkrimson Delicious

Whole tree variation of Starking Delicious; Oregon 1953.

Harvested mid-October. Processed late January. Medium- to large-sized fruit. Usually develops water core in storage. Medium SS and low TA.

Slices: Tested 1 year. Bright intense yellow. Tender, slightly grainy texture. Mild flavor. Good wholeness retention. Rated good overall.

Sauce: Tested 1 year. Green-yellow tan. Very coarse texture. Slightly aromatic flavor. Rated poor overall.

Juice: Tested 2 years. Poor color. Good flavor. Good total yield. Good specific gravity. Good pulp settlement during gravity clarification, giving good percentage of usable juice recovery. Rated good overall.

Good commercial processing potential for slices but not for sauce.

GOLDEN DELICIOUS TYPE

Golden Delicious

Parentage unknown -- chance seedling from West Virginia 1916.

Harvested mid-October. Processed late November. Moisture loss during storage causes skin to shrivel. Tendency to russet. Medium-sized fruit. Medium to high SS and low to medium TA.

Slices: Tested 14 years. Intense yellow. Tender, smooth texture. Good flavor. Fair to good wholeness retention. Rated good overall.

Sauce: Tested 13 years. Intense yellow. Fairly grainy, slightly coarse texture. Sweet flavor. Good base cultivar for sauce. Requires a lengthy blanch. Rated good overall.

Golden Delicious C-449

Spur of Golden Delicious.

Harvested mid-October. Processed late December to early January. Medium-sized fruit. Medium to high SS and low TA.

Slices: Tested 1 year. Bright intense yellow. Soft texture. Good flavor. Fair to good wholeness retention. Rated good overall.

Sauce: Tested 2 years. Bright intense yellow. Grainy texture. Good flavor. Rated good overall.

Compared with Golden Delicious, equal in quality but longer in storage life for the year tested. Further testing is required to determine storage life.

Honeygold

Golden Delicious x Haralson.

Harvested mid-October. Processed late November in fair condition. Some core mold. Medium SS and low TA.

Slices: Tested 1 year. Bright yellow. Tender, firm texture. Normal flavor. Very good wholeness retention. Rated excellent overall.

Sauce: Tested 1 year. Medium yellow. Slightly grainy texture. Slightly flat flavor. Rated good overall.

Slice quality is equal to Northern Spy but has better color. Sauce quality is also equal to Northern Spy, with slightly poorer color but better texture. Further studies are necessary to confirm that processing qualities are consistent.

Sinta

A seedling of Golden Delicious x Grimes Golden, named in 1970.

Harvested late October. Processed early December. Some shoulder russetting. Some core mold. Medium to high SS and low to medium TA.

Slices: Tested 3 years. Medium intense yellow. Soft, tender texture. Mild flavor. Fair wholeness retention. Rated good overall.

Sauce: Tested 4 years. Light tan-light yellow. Grainy texture. Mild flavor. Rated good overall.

BC-10C-6-12

Winesap x Golden Delicious, 1944 cross, selected in 1956 at Summerland, B.C.

Harvested mid-October. Processed late November. Slightly green flesh. Medium-sized fruit. High SS and medium TA. Easy peeler.

Slices: Tested 2 years. Light yellow to medium yellow. Tender texture. Good flavor. Good wholeness retention. Rated good overall.

Sauce: Tested 2 years. Light yellow to green-yellow. Coarse texture. Fair to good flavor. Rated fair overall.

Greater commercial processing potential for slices than for sauce. Further testing is necessary.

Smoothee

A true Golden Delicious mutation.

Harvested mid-October. Processed late December. Medium-sized fruit. High SS and low to medium TA. Easy peeler.

Slices: Tested 4 years. Intense yellow. Slightly soft texture. Mild flavor. Fair wholeness retention. Rated fair overall.

Sauce: Tested 4 years. Intense yellow. Slightly coarse grainy texture. Mild flavor. Rated good overall.

Juice: Tested 1 year. Light amber. Normal flavor. Fair total yield. Excellent specific gravity. Poor percentage of usable juice after clarification. Rated good overall.

Greater commercial processing potential for sauce than for slices. Further testing is required on juice to determine yield potential.

SCAB-RESISTANT TYPE

Britegold

Formerly O-652. Named in 1979. Parents include Melba, Red Delicious, and Sandow.

Harvested mid-October. Processed early November. Medium- to large-sized fruit. Yellow flesh. Oxidizes quickly. Difficult to blanch. Low to medium SS and low TA. Easy peeler.

Slices: Tested 2 years. Bright medium yellow. Mild flavor. Good wholeness retention. Rated good overall.

Sauce: Tested 1 year. Dull yellow. Coarse texture. Mild flavor. Rated fair overall.

Good commercial processing potential for slices but not for sauce. Further testing is necessary to confirm color.

Co-op No. 1

Parents include Starr, Wealthy, Melba, Red Rome, and Jonathan. Harvested early September. Processed early November. Small-sized fruit.

Sauce: Tested 1 year. Light cream. Good texture. Tart flavor. Rated fair overall.

Limited commercial processing potential for sauce.

Macfree

Formerly O-532. Named in 1974. Parents include McIntosh, Jonathan, Rome Beauty, and Malus floribunda 821.

Harvested mid-October. Processed late November. Small- to medium-sized fruit. White flesh with green tinge. Low to medium SS and TA. Easy peeler.

Slices: Tested 4 years. Dull cream. Smooth texture. Mild flavor. Fair wholeness retention. Rated fair overall.

Sauce: Tested 6 years. Dull cream-white. Slightly grainy texture. Mild flavor. Rated poor overall.

Juice: Tested 1 year. Very good color and flavor. Fair percentage of usable juice recovery. Rated good overall.

Limited commercial processing potential for either slices or sauce.

Moir

Formerly O-548. Named in 1979. McIntosh x Dg 22-81.
Harvested mid-October. Processed early December. Medium-sized fruit.
White flesh, sometimes with pink streaks. Slightly elongated.
Medium to low SS and medium TA. Easy peeler.
Slices: Tested 6 years. White. Tender to tough texture. Mild flavor.
Fair to excellent wholeness retention. Rated poor overall.
Sauce: Tested 6 years. Creamy white. Smooth to slightly grainy
texture. Mild to slightly perfumy flavor. Rated poor overall.
Juice: Tested 1 year. Fair total yield. Fair specific gravity.
Limited information available. Rated fair overall.

Limited commercial processing potential.

Murray

Formerly O-628. Named in 1979. McIntosh x 52-05-26.
Harvested late August to mid-September. Processed early November.
Small- to medium-sized fruit. Low SS and TA.
Slices: Tested 1 year. Dull white. Very soft texture. Normal
flavor. Fair wholeness retention. Rated poor overall.
Sauce: Tested 2 years. Dull white. Smooth texture. Mild flavor.
Rated poor overall.
Juice: Tested 1 year. Good color. Poor flavor. Fair total yield.
Rated fair overall.

Limited commercial processing potential.

Prima

Formerly Co-op No. 2. Named in 1970. Parents include Rome Beauty,
Malus floribunda 821, and Golden Delicious.
Harvested late September. Processed early November. Medium-sized
fruit. White flesh with green tinge. Medium SS and TA. Irregular
shape.
Slices: Tested 2 years. Bright medium yellow. Good texture.
Good wholeness retention. Fair to good flavor. Rated good overall.
Sauce: Tested 2 years. Light yellow. Grainy texture. Fair flavor.
Rated good overall.
Juice: Tested 2 years. Excellent color. Poor to fair flavor.
Fair total yield. Rated fair overall.

Flavor detracts from both slice quality and sauce quality and is
objectionable in juice.

Priscilla

Formerly Co-op No. 4. Named in 1972. Parents include Red Delicious, Rome Beauty, Golden Delicious, and McIntosh. Harvested early October. Processed late November to early January. Medium- to large-sized fruit. Oxidizes quickly. Sometimes develops water core in storage. Yellow flesh. Difficult to blanch. Medium to high SS and low TA.

Slices: Tested 2 years. Intense yellow. Fair to good texture. Good flavor. Fair wholeness retention. Rated good overall.

Sauce: Tested 3 years. Light yellow. Coarse grainy texture. Good flavor. Rated good overall.

Juice: Tested 2 years. Poor color. Poor to fair flavor. Fair total yield. Rated fair overall.

Limited commercial processing potential for juice.

Sir Prize

Formerly Co-op No. 5 and P-673-20. Parents include Rome Beauty, Malus floribunda 821, Golden Delicious, and Doud.

Harvested late September. Processed early December. Shape similar to that of Delicious. High SS and TA. Difficult peeler.

Slices: Tested 1 year. Bright yellow. Soft texture. Slightly tart flavor. Poor wholeness retention. Rated fair overall.

Sauce: Tested 1 year. Bright yellow. Fine grainy texture. Tart flavor. Rated good overall.

High acid tart flavor could enhance flavor of more bland cultivars in blends for sauce or juice.

Trent

Formerly O-531. Named in 1979. Parents include McIntosh, Jonathan, Rome Beauty, and Malus floribunda 821.

Harvested mid-October. Processed late January. Stores well until April. Medium-sized fruit. Some bitter pit. Medium SS and TA. Easy peeler.

Slices: Tested 12 years. Light yellow. Firm texture. Normal flavor. Fair to good wholeness retention. Rated good overall.

Sauce: Tested 9 years. Light yellow. Slightly grainy texture. Normal flavor. Rated good overall.

Juice: Tested 3 years. Good color. Watery weak flavor. Poor to fair total yield. Excellent for pulp settlement in pressed juice after clarification. Rated fair overall.

Greater commercial processing potential for slices and sauce than for juice.

0-521

Parents include Melba, Jonathan, Rome Beauty, and Malus floribunda 821. Harvested late September. Processed late November. Small- to medium-sized fruit. Large core cavity. Shape similar to that of Delicious. Low to medium SS and medium to high TA. Difficult peeler.

Slices: Tested 8 years. Cream-white. Tender texture. Tart flavor. Fair wholeness retention. Rated fair overall.

Sauce: Tested 9 years. Light yellow to cream-white with tinge of green or tan. Smooth texture. Very tart flavor. Rated fair overall.

Juice: Tested 5 years. Good to excellent color. Good flavor. Good total yield. Fair specific gravity. Fair percentage of usable juice after clarification. Rated good overall.

Although color and texture are not ideal, the high acid tart flavor should be useful to upgrade more bland cultivars in sauce and juice production.

0-5210

Parents include Melba, Jonathan, Rome Beauty, and Malus floribunda 821. Harvested late August. Processed early November. Medium-sized fruit. Oblong shape.

Sauce: Tested 1 year. Dull white. Coarse texture. Perfumy flavor. Rated poor overall.

Poor commercial processing potential.

0-544

Parents include McIntosh, Jonathan, Rome Beauty, and Malus floribunda 821. Harvested late October to early November. Processed early December. Small- to medium-sized fruit. White flesh. Medium to high SS and low to medium TA.

Slices: Tested 4 years. Dull white. Poor texture. Mild flavor. Poor to fair wholeness retention. Rated poor overall.

Sauce: Tested 5 years. Cream-white. Slightly coarse grainy texture. Mild flavor. Rated fair overall.

Juice: Tested 1 year. Poor dark amber. Fair flavor. Fair total yield. Excellent specific gravity. Poor percentage of usable juice after clarification. Rated poor overall.

Poor commercial processing potential.

0-545

Parents include McIntosh, Jonathan, Rome Beauty, and Malus floribunda 821. Harvested early September to early October. Processed mid-November to early January. Medium-sized fruit. White flesh. Slightly elongated. Medium SS and TA. Easy peeler.

Slices: Tested 5 years. Light yellow. Very soft texture. Slightly tart flavor. Poor wholeness retention. Rated fair overall.
Sauce: Tested 6 years. Light yellow. Smooth to slightly grainy texture. Slightly tart flavor. Rated good overall.
Juice: Tested 1 year. Poor total yield. Poor specific gravity. Rated poor overall.

Some commercial processing potential for sauce but limited value for both slice and juice production.

0-546

Parents include Rome Beauty, Jonathan, McIntosh, and Malus floribunda 821. Harvested late October. Processed December to mid-January. Medium-sized fruit. Low SS and medium TA. Easy peeler.
Slices: Tested 8 years. White to dull cream. Soft texture. Normal flavor. Fair to good wholeness retention. Rated fair overall.
Sauce: Tested 7 years. Cream-yellow to green-yellow. Smooth texture. Good flavor. Rated fair overall.
Juice: Tested 2 years. Fair color, flavor, and total yield. Rated fair overall.

Limited commercial processing potential because of low SS and lack of color.

0-547

McIntosh x Dg 20-9. Parents include McIntosh, Jonathan, Rome Beauty, and Malus floribunda 821. Harvested early October. Processed early November. Medium-sized fruit. Medium to high SS and low TA. Easy to peel. Oxidizes quickly. Difficult to blanch.
Sauce: Tested 2 years. Dull white. Coarse texture. Poor flavor. Rated poor overall.

Limited commercial processing potential.

0-5410

McIntosh x Dg 20-9. Parents include McIntosh, Jonathan, Rome Beauty, and Malus floribunda 821. Harvested late September. Processed early November. Small-sized fruit. Easy peeler.
Slices: Tested 1 year. Medium yellow. Firm, slightly tough texture. Fair to good flavor. Fair wholeness retention. Rated fair overall.
Sauce: Tested 1 year. Very light yellow. Good texture. Fair flavor. Rated fair overall.

Limited commercial processing potential because of the fair rating for both wholeness retention in slices and flavor in sauce.

0-5412

McIntosh x Dg 22-18.

Harvested late September to mid-October. Processed late November to mid-January. Medium-sized fruit. Some bitter pit. Medium SS and medium to high TA.

Slices: Tested 2 years. Dull brown-yellow. Soft to tough, rubbery texture. Mild flavor. Fair to good wholeness retention. Rated fair overall.

Sauce: Tested 3 years. Variable color (pink-white/green-yellow/bright light yellow). Smooth to coarse texture. Mild to very tart flavor. Rated fair overall.

Juice: Tested 1 year. Good color. Fair flavor. Fair total yield. Rated fair overall.

Quality variations in different test years indicate a need for further testing.

0-564

McIntosh x 10-147 Dg 20T9.

Harvested early October. Processed early December. No other information available.

Sauce: Tested 1 year. Cream-tan. Fair texture. Fair flavor. Rated fair overall.

Preliminary testing in 1973 suggests limited commercial processing potential.

0-591

49-121E x McIntosh.

Harvested late September. Processed late November. Medium-sized fruit. Medium SS and high TA. Easy to peel.

Slices: Tested 1 year. Bright intense yellow. Firm, tender texture. Good flavor. Good wholeness retention. Rated good overall.

Sauce: Tested 1 year. Cream-white. Smooth texture. Very tart flavor. Rated fair overall.

Color difference in products packed indicates further testing is required.

0-621

0-521 x McIntosh. Parents include Melba and McIntosh.

Harvested mid-September at Saint-Jean, Quebec, and early October at Smithfield Experimental Farm. Processed late November. Medium-sized fruit. Medium SS and high TA. Fair peeler.

Sauce: Tested 1 year. Cream-white. Smooth texture. Tart, aromatic flavor. Rated poor overall.

Juice: Tested 4 years. Medium amber. Good flavor. Poor total yield. Rated fair overall.

Poor commercial processing potential.

0-622

0-521 x McIntosh. Parents include Melba and McIntosh. Harvested late September at Saint-Jean, Quebec, and early October at Smithfield Experimental Farm. Processed early November. Medium-sized fruit. Medium SS and medium to high TA.
Slices: Tested 2 years. White-light tan. Poor texture. Poor flavor. Poor wholeness retention. Rated poor overall.
Sauce: Tested 1 year. Cream color. Soft texture. Fair flavor. Rated poor overall.
Juice: Tested 4 years. Light amber-yellow. Very good flavor. Fair total yield. Fair specific gravity. Rated good overall.

Limited commercial processing potential for juice; poor for sauce and slices.

0-623

0-521 x McIntosh. Parents include Melba and McIntosh. Harvested early September to early October. Processed late November to early January. Medium-sized fruit. Large core cavity. Medium SS and TA. Poor peeler. Elongated shape.
Sauce: Tested 1 year. Cream-white. Coarse texture. Mild, perfumy flavor. Rated poor overall.
Juice: Tested 4 years. Poor amber. Good flavor. Fair total yield. Fair specific gravity. Rated fair overall.

Limited commercial processing potential for either sauce or juice.

0-624

0-521 x McIntosh. Parents include Melba and McIntosh. Harvested mid-October. Processed late November. Should be processed early November. Medium SS and high TA.
Sauce: Tested 1 year. Cream-white. Very grainy texture. Tart flavor. Rated poor overall. Further testing is needed to verify storage life and sauce potential.

0-637

McIntosh x 0-525. Parents include McIntosh and Melba. Harvested early October. Processed late November. Medium-sized fruit. Medium SS and high TA. Easy peeler.
Slices: Tested 2 years. Yellow to cream-yellow. Soft texture. Normal flavor. Very good wholeness retention. Rated good overall.
Sauce: Tested 2 years. Light yellow to light tan. Smooth texture. Slightly tart, aromatic flavor. Rated poor overall.

Limited commercial processing potential for both slices and sauce.

0-642

McIntosh x 0-522. Parents include McIntosh and Melba.
Harvested mid-October at Saint-Jean, Quebec. Processed early February.
Low SS and TA.

Juice: Tested 1 year. Good color. Good flavor. Good total yield.
Poor specific gravity. Rated good overall.

0-644

0-527 x Lobo. Parents include Melba and Lobo.
Harvested late September. Processed mid-November. Small- to medium-sized fruit. Medium SS and high TA.

Slices: Tested 1 year. White. Soft texture. Tart flavor. Poor wholeness retention. Rated poor overall.

Sauce: Tested 1 year. White. Smooth texture. Tart, aromatic flavor. Rated poor overall.

Limited or no commercial processing potential.

0-645

0-527 x Lobo. Parents include Melba and Lobo.
Harvested mid-September. Processed late November. Medium- to large-sized fruit. Scald in storage. Medium SS and TA.

Slices: Tested 1 year. Bright light tan to yellow. Mealy texture. Normal flavor. Fair wholeness retention. Rated fair overall.

Sauce: Tested 1 year. Bright light tan to yellow. Smooth texture. Aromatic flavor. Rated poor overall.

Limited commercial processing potential.

0-646

McIntosh x 0-522. Parents include McIntosh and Melba.
Harvested late September. Processed late October. Small-sized fruit. White flesh. Medium SS and TA.

Slices: Tested 1 year. White. Fair texture. Mild, flat flavor. Fair to good wholeness. Rated fair overall.

Sauce: Tested 1 year. Cream-white. Smooth texture. Aromatic flavor. Rated poor overall.

Limited or no commercial processing potential.

0-6412

McIntosh x 0-522. Parents include McIntosh and Melba.
Harvested early October. Processed late November. Medium-sized fruit. In 1981, some core mold. Medium SS and TA. Easy peeler.

Slices: Tested 1 year. Light yellow to light tan. Soft, smooth texture. Mild, slightly aromatic flavor. Fair wholeness retention. Rated poor overall.

Sauce: Tested 2 years. Bright intense yellow. Grainy texture. Excellent flavor. Rated excellent overall.

Rated top cultivar for sauce in both years tested. Poor potential for slices based on 1981 test year. Marked color and flavor differences between the two pack types indicate a need for further testing.

0-6413

0-527 x Lobo. Parents include Melba and Lobo. Harvested mid-October. Processed late November. Small-sized fruit. Medium SS and TA. Easy peeler.
Slices: Tested 1 year. Light yellow. Good texture. Very good flavor. Good wholeness retention. Rated good overall.
Sauce: Tested 1 year. Light yellow. Slightly grainy texture. Good flavor. Rated good overall.

Good commercial processing potential. Slice quality better than that of Northern Spy in 1974.

0-654

0-522 x Sandel. Parents include Melba, Red Delicious, and Sandow. Harvested late September to early October. Processed late November to early January. Best in early December. In 1981, this cultivar had stem-end russetting and internal breakdown. Medium-sized fruit. Medium SS and TA. Easy peeler.
Slices: Tested 2 years. Bright light yellow. Tender texture. Slightly tart, aromatic flavor. Fair to good wholeness retention. Rated good overall.
Sauce: Tested 2 years. Light yellow. Fine grainy texture (coarse in 1981). Good flavor. Rated good overall.

Flavor and texture differences in both years tested indicate that more information is needed.

0-661

0-521 x Delicious. Parents include Melba and Red Delicious. Harvested early October. Processed mid-December. Medium-sized fruit. Low SS and medium TA. Easy peeler.
Slices: Tested 1 year. Green-yellow. Tender, smooth texture. Slightly tart flavor. Good wholeness retention. Rated good overall.
Sauce: Tested 1 year. Green-yellow. Smooth texture. Very tart flavor. Rated poor overall.

Greater commercial processing potential for slices than for sauce.

0-663

0-521 x T-3919. Parents include Melba, Red Delicious, and McIntosh. Harvested early October. Processed late November. Small- to medium-sized fruit. Elongated shape. Medium SS and TA.

Slices: Tested 1 year. White. Soft texture. Fair flavor. Fair to good wholeness retention. Some slice breakdown during blanching. Rated poor overall.

Sauce: Tested 1 year. Cream-white. Smooth texture. Mild flavor. Rated poor overall.

Limited or no commercial processing potential.

0-665

0-522 x Delicious. Parents include Melba and Red Delicious. Harvested early October. Processed mid-November. Medium-sized fruit. Medium SS and low to medium TA. Elongated shape. Slightly difficult peeler. Slight core browning.

Slices: Tested 2 years. Bright light yellow. Slightly tough texture. Mild flavor. Good wholeness retention. Rated good overall.

Sauce: Tested 2 years. Bright yellow. Slightly coarse grainy texture. Mild flavor. Rated good overall.

Texture and color varied in both years tested.

Good commercial processing potential.

0-6611

0-521 x T-3919. Parents include Melba, Red Delicious, and McIntosh. Harvested late September. Processed mid-January. Medium-sized fruit. Slightly elongated. Good appearance. Medium SS and high TA.

Slices: Tested 1 year. Dull white. Very soft texture. Tart flavor. Poor wholeness retention. Rated poor overall.

Sauce: Tested 1 year. Cream-white. Smooth texture. Very tart flavor. Rated poor overall.

Limited or no commercial processing potential.

OTHER TYPES (MOSTLY ESTABLISHED VARIETIES)

Anderson Jonathan

An open-pollinated seedling of Esopus x Spitzenberg. Harvested mid-October. Stores well until December. Medium-sized fruit. Medium SS and TA. (In 1981, high SS and TA. Some bitter pit. Kept well until mid-January.) Easy peeler.

Slices: Tested 4 years. Bright yellow. Slightly coarse texture. Good flavor. Very good wholeness retention. Rated good overall.

Sauce: Tested 4 years. Bright yellow. Slightly coarse texture. Normal flavor. Rated good overall.

Good commercial processing potential.

Chieftain

Jonathan x Delicious.

Harvested mid-October. Processed mid-January. Medium-sized fruit. Shape similar to that of Delicious. High SS and low to medium TA.

Slices: Tested 3 years. Bright yellow. Soft, tender texture.

Good flavor. Fair wholeness retention. Rated good overall.

Sauce: Tested 4 years. Bright intense yellow. Grainy texture. Normal flavor. Rated good overall.

Good commercial processing potential, particularly for sauce.

Empire

McIntosh x Delicious.

Harvested mid-October. Processed late November to early January.

Medium-sized fruit. White flesh. Medium SS and TA. Easy peeler.

Slices: Tested 5 years. Bright light yellow. Tender to slightly chewy texture. Mild to slightly tart flavor. Good wholeness retention despite tendency to some breakage during slice preparation. Rated good overall.

Sauce: Tested 5 years. Light yellow. Fine grainy texture. Mild flavor. Rated good overall.

Juice: Tested 1 year. Excellent light yellow. Excellent total yield.

Good pulp settlement during gravity clarification, giving good percentage of usable juice recovery. Excellent flavor. Fair specific gravity. Best of cultivars juiced in 1981. Rated excellent overall.

Good commercial processing potential.

George

An open-pollinated seedling of McIntosh.

Harvested early October. Processed late November. Large-sized fruit. Medium SS and low TA. Easy peeler.

Slices: Tested 1 year. Bright yellow. Slightly tough texture. Mild flavor. Good wholeness retention. Rated good overall.

Sauce: Tested 2 years. Bright medium yellow. Grainy texture. Mild flavor. Rated good overall.

Good commercial processing potential indicated but further testing is required.

Idared

Jonathan x Wagener. Named in 1942 by University of Idaho.

Harvested mid-October. Processed mid-January or later. Exceptional storage life. Medium-sized fruit. High SS and medium TA. Easy peeler.

Slices: Tested 6 years. Cream. Slightly tough texture. Mild flavor. Good wholeness retention. Rated fair overall.

Sauce: Tested 7 years. Cream-white. Slightly grainy texture. Mild flavor. Rated fair overall.

Juice: Tested 2 years. Excellent color. Good to excellent flavor. Good initial yield. Good pulp settlement during clarification, giving good percentage of usable juice recovery. Rated good overall.

Good commercial processing potential for juice; limited for sauce and slices.

Jonnee

Bud mutation of Blackjon.

Harvested early to mid-October. Processed early January. Medium-sized fruit. High SS and medium TA. Easy peeler.

Slices: Tested 3 years. Bright yellow. Tender, slightly grainy texture. Good flavor. Good wholeness retention. Rated good overall.

Sauce: Tested 4 years. Bright yellow. Slightly grainy texture. Normal flavor. Rated good overall.

Jonnee compares well with several reference varieties, such as Empire, but quality is usually lower than that of Northern Spy.

Jerseyred

Gallia Beauty x White Winter Pearmain.

Harvested mid-October. Processed late January. Medium-sized fruit. High SS and medium TA.

Slices: Tested 1 year. Light yellow. Soft texture. Normal flavor. Fair wholeness retention. Rated fair overall.

Sauce: Tested 1 year. Bright medium yellow. Smooth texture. Good flavor. Rated good overall.

Slightly more commercial processing potential for sauce than for slices.

Loyalist

Formerly T-416. Named in 1979. Linda x Yellow Newtown.

Harvested mid-October. Processed late January. Medium-sized fruit. Cream flesh. High SS and medium TA. Easy peeler.

Slices: Tested 10 years. Bright yellow. Tender, crisp texture. Good flavor. Good wholeness retention. Rated good overall.

Sauce: Tested 9 years. Bright yellow. Grainy texture. Good flavor. Rated good overall.

Juice: Tested 2 years. Excellent color. Poor to fair flavor. Fair total yield. Good specific gravity. Poor percentage of usable juice after clarification. Rated fair overall.

Compares well with Northern Spy in sauce and slice quality and is always in top 20% of cultivars tested.

Lindel

Formerly T-397. Named in 1971. Richared Delicious x Linda. Harvested mid-October. Processed mid-January. Medium-sized fruit. Medium SS and low to medium TA. Has shape of Richared Delicious plus deep crevices. Difficult peeler.

Slices: Tested 15 years. Bright medium yellow. Tender to slightly soft texture. Mild flavor. Fair to good wholeness retention. Rated good overall.

Sauce: Tested 14 years. Bright intense yellow. Coarse grainy texture. Good flavor. Rated good overall.

Juice: Tested 5 years. Fair to good color, total yield, and specific gravity. Fair percentage of usable juice recovery. Poor flavor. Rated fair overall.

Good commercial processing potential for slices and sauce but not for juice.

Melrose

Jonathan x Delicious.

Harvested mid-October. Processed late January to early February. Large-sized fruit. High SS and medium TA. Difficult peeler.

Slices: Tested 11 years. Bright light yellow. Good texture. Good flavor. Good wholeness retention. Rated good overall.

Sauce: Tested 10 years. Bright medium yellow. Coarse grainy texture. Mild flavor. Requires a longer-than-usual blanch time. High water absorbency. Rated good overall.

Good commercial processing potential.

Moss's Seedling

From seed sown at Chetwynd End Nurseries, Newport, Shropshire, England, in 1955.

Harvested mid-October. Processed late December. Large-sized fruit. High SS and medium TA. Easy peeler.

Slices: Tested 2 years. Bright yellow. Tender, slightly soft texture. Mild flavor. Fair to good wholeness retention. Rated good overall.

Sauce: Tested 2 years. Bright yellow. Grainy texture. Slightly aromatic flavor. Rated good overall.

Good commercial processing potential.

Mutsu

A seedling of Golden Delicious x Indo, from Japan. Called Crispin in England.

Harvested late October. Processed mid-January. Large-sized fruit. In 1981, some bitter pit and some internal breakdown. Medium to high SS and medium TA. Difficult peeler.

Slices: Tested 4 years. Bright intense yellow. Soft texture. Fair to good flavor. Poor wholeness retention. Rated fair overall.
Sauce: Tested 5 years. Bright intense yellow. Grainy texture. Good flavor. Rated good overall.

Fair commercial processing potential for slices. Sauce has good blending potential.

Northern Spy

Parentage unknown.
Harvested late October. Processed early January. Large-sized fruit. Bitter pit most years. Medium to high SS and medium TA.
Slices: Tested 20 years. Bright intense yellow. Good texture. Good flavor. Good wholeness retention. Rated excellent overall.
Sauce: Tested 19 years. Bright intense yellow. Very grainy texture. Good flavor. Rated excellent overall.
Juice: Tested 2 years. Good color. Fair to good flavor. Good total yield. Good specific gravity. Good pulp settlement during gravity clarification. Fair percentage of usable juice recovery. Rated good overall.

As it was 20 years ago, Northern Spy remains the high-quality standard variety for slices and sauce.

Rhode Island Greening

Parentage unknown. More than 200 years old.
Harvested mid-October. Processed mid-January. Medium SS and TA. Storage quality variable unless picked at full maturity. Easy peeler.
Slices: Tested 8 years. Green-tan yellow. Good texture. Fair flavor. Fair wholeness retention. Rated good overall.
Sauce: Tested 7 years. Green-yellow. Grainy texture most years. Fair, slightly tart flavor. Rated good overall.

Storage and processing qualities are influenced by harvest maturity; often picked before full maturity.

Golden Russet

Parentage unknown.
Harvested mid-October. Processed late January. High SS and medium TA.
Slices: Tested 1 year. Bright glossy yellow. Soft texture. Fair flavor. Fair wholeness retention. Rated fair overall.
Sauce: Tested 1 year. Bright yellow. Very grainy texture. Good mild flavor. A good base variety, useful in blends to improve overall color and grain. Rated excellent overall.

Greater commercial processing potential for sauce than for slices. Well known in Quebec for its good cider-making qualities.

Sandel

Named in 1979. Delicious x Sandow.

Harvested mid-October. Processed mid-January to late January. Medium-sized fruit. Difficult to blanch. Medium SS and low TA.

Slices: Tested 2 years. Good yellow color. Fair to good texture. Fair flavor. Excellent wholeness retention. Rated good overall.

Sauce: Tested 5 years. Bright intense yellow. Grainy texture.

High water absorbency. Good flavor. Rated good overall.

Juice: Tested 1 year. Light amber. Mild, slightly aromatic flavor.

Fair total yield. Fair percentage of usable juice recovery. Rated fair overall.

The sauce quality of this cultivar would upgrade the quality of other cultivars in blends. Fair commercial processing potential for slices. One year's testing suggests limited commercial processing potential for juicing.

Spartan

McIntosh x Yellow Newtown seedling named in 1936.

Harvested late September. Processed late December. Small- to medium-sized fruit. Medium to high SS and low to medium TA.

Slices: Tested 8 years. Poor color. Poor to fair texture. Fair flavor. Poor wholeness retention. Rated poor overall.

Sauce: Tested 7 years. Light yellow. Fair texture. Fair flavor. Rated fair overall.

Juice: Tested 3 years. Excellent color. Fair to good flavor. Fair total yield. Rated good overall.

Some commercial processing potential for juice and sauce but not for slices.

Spigold

Red Spy x Golden Delicious.

Harvested mid-October. Processed mid-December. Large-sized fruit. Medium to high SS and medium TA.

Slices: Tested 2 years. Bright intense yellow. Tender, slightly soft texture. Excellent flavor. Good wholeness retention. Rated excellent overall.

Sauce: Tested 5 years. Intense yellow. Grainy texture. Mild flavor. Rated good overall.

Juice: Tested 1 year. Poor dark amber. Excellent flavor. Good specific gravity. Good initial yield. Good pulp settlement during gravity clarification, giving excellent percentage of usable juice recovery. Rated good overall.

Good commercial processing potential for slices and sauce. Poor color lowered its potential for juice in the year tested.

Tydeman's Red

McIntosh x Worcester Pearmain. Named in 1964.

Harvested early September. Processed late November; may offer better potential if processed earlier, at a firmer maturity. Large-sized fruit. Medium SS and TA.

Slices: Tested 1 year. Medium yellow. Tender, dry texture.

Good flavor. Very good wholeness retention. Rated good overall.

Sauce: Tested 2 years. Light tan to light yellow. Smooth texture.

Mild flavor. Rated fair overall.

This variety probably has more commercial processing potential for slices than for sauce.

West Virginia Red York

Bud mutation of York Imperial.

Harvested late October. Processed late January. Medium-sized fruit. In 1981, some storage breakdown. Remains firm even at full maturity. High SS and low to medium TA.

Slices: Tested 2 years. Bright medium yellow. Tender, crisp texture. Slightly aromatic flavor. Excellent wholeness retention. Rated good overall.

Sauce: Tested 2 years. Excellent color, permitting upgrading of other cultivars in blends. Coarse grainy texture. Mild flavor. Rated good overall.

Table 2. Summary of quality ratings for the most promising apple cultivars tested*

Cultivar	Slices				Sauce			Juice		
	Color	Texture	Flavor	Wholeness	Color	Texture	Flavor	Color	Flavor	Yield
Anderson Jonathan	G	G	G	G	G	G	G			
Britegold**	G	G	G	G						
BC-10C-6-12	G	G	G	G	F	F	F			
Chieftain	G	G	G	F	E	G	G			
Empire	G	G	G	G	F	G	G	E	E	G
George	E	G	G	G	G	G	G			
Golden Delicious	E	G	G	G	G	G	G			
Golden Delicious C-449	E	G	G	G	G	G	G			
Golden Russet	G	F	F	F	E	E	G			
Honeygold	E	E	G	E	G	G	F			
Idared	F	F	G	G	F	G	G	E	G	G
Jonnee	G	G	G	G	G	G	G			
Loyalist	E	G	G	G	E	G	G	E	F	F
McIntosh VC309	P	P	G	P	P	F	G	F	E	G
Melrose	G	G	G	G	G	G	G			
Miller Sturdeespur Delicious	E	F	G	G	E	F	G	P	P	G
Moss's Seedling	G	G	G	G	G	G	F			
Mutsu	E	F	G	F	E	G	G			
Northern Spy	E	E	E	E	E	E	E	G	G	G
0-521**	P	G	G	F	F	F	F	F	G	G
0-591**	E	G	G	G	F	F	F			
0-6412**	F	F	F	F	E	G	G			
0-6413**	G	G	G	G	G	G	G			
0-665**	G	G	G	G	G	G	G			
Prima**	G	G	G	G	G	G	G	E	F	F
Priscilla**	G	G	G	F	G	G	G	F	F	F
Rhode Island Greening	G	G	G	F	F	G	G			
Richared Delicious	E	G	G	G	E	F	G			

Sandel	G	G	F	E	E	G	G	G	F	F
Sinta	E	G	G	F	F	G	G			
Sir Prize**	G	F	G	P	G	G	G			
Smoothee	G	F	G	F	G	G	G	G	G	F
Spigold	E	E	E	E	E	G	G	F	E	G
Starkrimson Delicious	E	G	G	G	P	P	P	P	G	G
Trent**	G	F	G	G	G	G	G	E	F	F
Tydemans Red	G	G	G	E	F	F	F			
West Virginia Red York	G	G	F	E	E	F	G			

*McIntosh VC309, Northern Spy, Richared Delicious, Golden Delicious, Empire, and Idared are included as standards regardless of "promising" rating.

**Scab-resistant type

CONVERSION FACTORS

Metric units	Approximate conversion factors	Results in:
LINEAR		
millimetre (mm)	× 0.04	inch
centimetre (cm)	× 0.39	inch
metre (m)	× 3.28	feet
kilometre (km)	× 0.62	mile
AREA		
square centimetre (cm ²)	× 0.15	square inch
square metre (m ²)	× 1.2	square yards
square kilometre (km ²)	× 0.39	square mile
hectare (ha)	× 2.5	acres
VOLUME		
cubic centimetre (cm ³)	× 0.06	cubic inch
cubic metre (m ³)	× 35.31	cubic feet
cubic metre (m ³)	× 1.31	cubic yards
CAPACITY		
litre (L)	× 0.035	cubic foot
hectolitre (hL)	× 22	gallons
hectolitre (hL)	× 2.5	bushels
WEIGHT		
gram (g)	× 0.04	oz avdp
kilogram (kg)	× 2.2	lb avdp
tonne (t)	× 1.1	short tons
AGRICULTURAL		
litres per hectare (L/ha)	× 0.089	gallons per acre
litres per hectare (L/ha)	× 0.357	quarts per acre
litres per hectare (L/ha)	× 0.71	pints per acre
millilitres per hectare (mL/ha)	× 0.014	fl. oz per acre
tonnes per hectare (t/ha)	× 0.45	tons per acre
kilograms per hectare (kg/ha)	× 0.89	lb per acre
grams per hectare (g/ha)	× 0.014	oz avdp per acre
plants per hectare (plants/ha)	× 0.405	plants per acre

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